IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.:	09/574,697
Applicants:	Chau, Paul
Filed:	05/17/2000
Title:	Integrated Circuit Card Interface Device with Multiple Modes of Operation
Art Unit:	2194
Examiner:	Nguyen, Van
Atty. Docket No.:	18526
Customer No.:	23676

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 C.F.R. § 1.131

I, Paul Chau, declare that:

1. I am a co-inventor of the subject matter claimed in the above-identified non-provisional patent application (U.S. Serial No. 09/574,697).

2. I understand that the application includes the following claims:

Claim 2

The integrated circuit card interface device of claim 43, wherein said application memory further comprises a read-only memory.

Claim 3

The integrated circuit card interface device of claim 43, wherein said application memory further comprises an electrically erasable programmable read-only memory.

Claim 4

The integrated circuit card interface device of claim 43, wherein said application engine further comprises a microcontroller.

Claim 5

The integrated circuit card interface device of claim 4, wherein said microcontroller further comprises said application memory.

Claim 6

The integrated circuit card interface device of claim 43, wherein said input/output module comprises a microcontroller.

Claim 7

The integrated circuit card interface device of claim 43, wherein said application engine further comprises a custom circuit.

Claim 8

The integrated circuit card interface device of claim 7, wherein said custom circuit further comprises said application memory.

Claim 9

The integrated circuit card interface device of claim 43, wherein said input/output module further comprises a custom circuit.

Claim 41

The integrated circuit card interface device of claim 43, wherein the interface device is portable.

Claim 43

An integrated circuit card interface device comprising:

an application memory;

an application engine for managing one or more applications in said application memory;

an input/output module;

a host interface;

one or more integrated circuit card interfaces; and

an internal power supply;

wherein the interface device is adapted to enable operation in accordance with multiple modes of operation comprising

a standalone mode of operation in which the interface device is not operably connected to any host device via the host interface, and

a reprogramming mode of operation, in which the interface device is operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces, and/or to a host device via the host interface, to enable one or more programs to be added to, modified in, or deleted from, the interface device.

Claim 44

The integrated circuit card interface device of claim 43, wherein the standalone mode of operation comprises a mode of operation in which the interface device is operably connected to an integrated circuit card via one of the

one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 45

The integrated circuit card interface device of claim 44, wherein the standalone mode of operation further comprises a mode of operation in which the interface device is not operably connected to another device to enable communication therebetween.

Claim 46

The integrated circuit card interface device of claim 45, wherein the multiple modes of operation further comprise a connected mode of operation in which the interface device is operably connected to a host device via the host interface to enable communication between the interface device and the host device.

Claim 47

The integrated circuit card interface device of claim 46, wherein during the connected mode of operation the interface device is also operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 48

The integrated circuit card interface device of claim 44, wherein the multiple modes of operation further comprise a mode of operation in which the interface device is operably connected to a host device via the host interface to enable communication between the interface device and the host device.

Claim 49

The integrated circuit card interface device of claim 43, wherein during the

connected mode of operation the interface device is also operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 50

The integrated circuit card interface device of claim 43, wherein the standalone mode of operation comprises a mode of operation in which the interface device is not operably connected to another device to enable communication therebetween.

Claim 51

The integrated circuit card interface device of claim 50, where the multiple modes of operation further comprise a connected mode of operation in which the interface device is operably connected to a host device via the host interface to enable communication between the interface device and the host device.

Claim 52

The integrated circuit card interface device of claim 51, wherein during the connected mode of operation the interface device is also operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 53

The integrated circuit card interface device of claim 43, wherein the multiple modes of operation further comprise a connected mode of operation in which the interface device is operable connected to a host device via the host interface to enable communication between the interface device and the host device.

Claim 54

The integrated circuit card interface device of claim 53, wherein during the connected mode of operation the interface device is also operably connected to an integrated circuit card via one of the one or more integrated circuit card interfaces to enable communication between the interface device and the integrated circuit card.

Claim 68

The integrated circuit card interface device of claim 43, further comprising:

a display unit; and

an input unit.

Claim 69

A portable integrated circuit card interface device, comprising:

an application memory;

an application engine for managing one or more applications in said application memory;

an input/output module;

a host interface;

one or more integrated circuit card interfaces;

means for operation without external power;

means for a standalone mode of operation in which the interface device is not operably connected to a host device via the host interface, and

means for a reprogramming mode of operation for adding, modifying, or deleting programs from the interface device.

Claim 78

The integrated circuit card interface device of claim 43, wherein the one or more programs are subject to security verification.

Claim 79

The integrated circuit card interface device of claim 43, wherein the interface device is operable while being carried by a user.

3. Prior to February 1, 1999, my coinventors and I conceived the present invention in the United States.

4. Prior to February 1, 1999, I documented the principal features of the present invention in a laboratory notebook, two pages of which are shown in Exhibit A. Exhibit A has been redacted to remove the date shown thereon. This date, however, precedes February 1, 1999.

5. Exhibit B comprises several Spyrus Invention Idea Forms which my coinventors Gerry Vandenengel and Kerry Mathew, and I, completed prior to February 1, 1999, and which disclose the present invention, including all of the limitations of claims 2-9, 41, 43-54, 68, 69, 78, and 79. Exhibit B has been redacted to remove all dates shown thereon. All such dates, however, precede February 1, 1999. Exhibit B has also been redacted to remove certain parts not necessary for purposes of this declaration.

6. Exhibit C comprises two schematic diagrams, illustrating a circuit from which a prototype, the Development Platform, was constructed. The Development Platform comprised two printed circuit boards. Exhibit C has been redacted to remove all dates shown thereon. All such dates, however, precede February 1, 1999.

7. Prior to February 1, 1999, I used the Development Platform in the United States to demonstrate the feasibility and function of the present invention, including all of

the limitations of claims 2-9, 41, 43-54, 68, 69, 78, and 79. .

I hereby declare that all statements made herein of my own knowledge are true and that the statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the U.S. Code and that such willful false statements may jeopardize the validity of the application of any patent issued thereon.

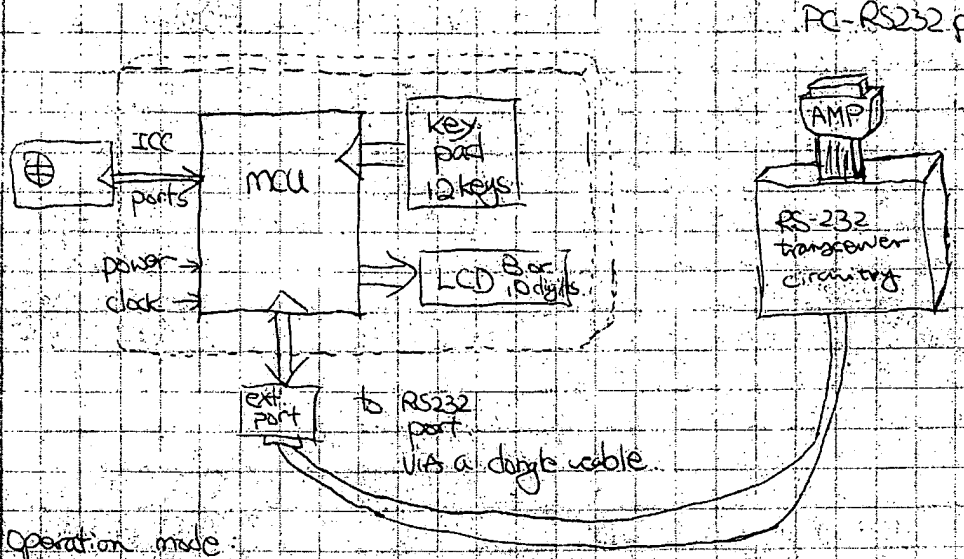
Date: March 03, 2009

Paul Chau

Exhibit A

[redacted]

Design block Diagram



Operation mode:

① Standalone / passive mode

External port and the keypad data entry module are not active the unit is used to provide static (pre-defined) data from the card eg. balance of purse. This mode is active when the power-on button is pressed, then the unit will provide the continuous display of information on the LCD until it reaches the end of the display sequence. At the end of display, if no key is pressed the unit will time itself out in 2 seconds.

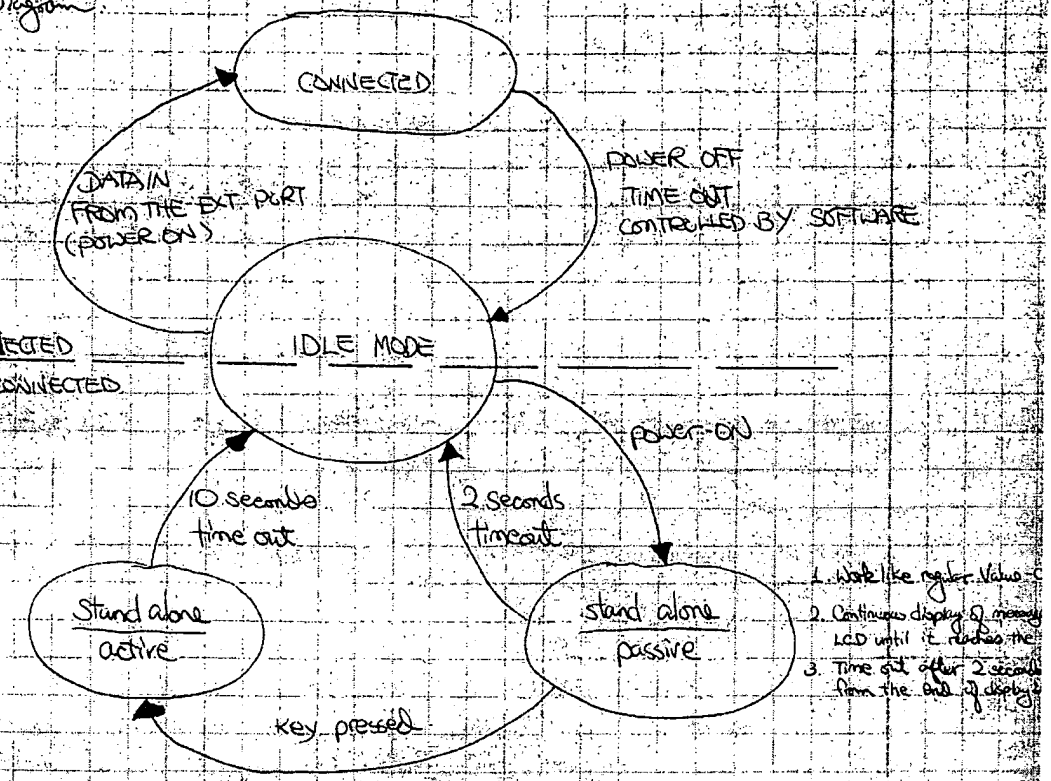
② Standalone / active mode

External port is not active. Upon power on, user can interrupt the display routine sequence of the static data by pressing another key on the keypad. Once the unit is in the active mode, the LCD will display message to instruct user to enter data. At anytime when no keying activities happened, the unit will time out in 10 seconds.

③ Connected mode

~~Upon~~ When the unit is connected to the PC through through the special cable, it will stay at the connected mode. At this point, instruction and data will be coming in and out through the external port. Also the power might be supplied by the external source as well. Therefore the unit's power will be controlled by the PC. Any time out routine will be handled by the software.

State Diagram



Application

① Standalone/passive mode
- predefined data/info display of the IC card
- command and procedure needed to be masked into the mcu.
- Self start routine upon ~~pow~~ power on

② Standalone/active mode
- selective display of IC card data, eg. to display the 4th latest/latest payment rec
- IC card locking and unlocking through pin ~~enter~~ presentation
- IC card data record update, external data can be transferred into the card
- optional calculator function ?

③ connected mode
- Complex applications designed at the high level can be translated into APDU command and sent through the RS232 path. Data response from the IC will be returned through the same path
- eg transform the unit/system to be a home banking machine through the PC.

Exhibit B

SPYRUS

SPYRUS INVENTION IDEA FORM

Docket No. (to be assigned by SPYRUS legal): PAT3P4-01-4025

Name of person completing this form: Paul Chau

Date this form was completed: [redacted]

The purpose of this form is to provide a brief description of any ideas that you feel could lead to patentable inventions by SPYRUS. It should be filled out and filed with the Legal Office. Once completed, a determination will be made of whether to proceed with a full invention disclosure.

SPYRUS is committed to building a strong patent portfolio, both to protect our intellectual property rights and to strengthen our corporate position. Please document anything that you may be working on which you feel could be patented.

RECEIVED [redacted] BY:

All of the following entries should be made in ink or type.

I. Give a descriptive title of the invention:

The design of an IC Card interface system with application reload capability

II. Give a brief statement explaining the essence of the invention and what benefit it provides. Use the space below (and on back, if necessary) for a sketch showing the important components of the invention.

The invention involves the design of a reloadable reader for use with IC Card. Among all the existing IC Card reader, it can be categorized into two groups. The first group is designed to work with a specified set of cards and has card application embedded into the masked ROM of the micro-controller in the reader. This group of reader cannot be modified to work with other IC Card once it has been built. The second group is designed to be a generic IC Card reader connected to a host. The card application is running in the host and the reader is merely served as an interface conduit. This group of reader does not offer any standalone application capabilities. The invention proposed in here is a new kind of reader, which captures the advantage from both groups of reader. The reader contains internal algorithm that can be updated with a secure download process. The internal algorithm enable the reader to be used in standalone mode and the reloadable capability allows the reader to be updated to support for new card or applications. The reader is also capable to be used in connected mode application. At this mode, the internal algorithm is disable, and the application is running at the host and using the resources in the reader.

background

solution

Internal design of the reloadable reader has two major blocks: Application Engine and an IO Engine. See attached block diagram for more details.

SIGNATURE [signature]

DATE [redacted]

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SPYRUS INVENTION IDEA FORM

Docket No. (to be assigned by SPYRUS legal): PA0887-01-4030

Name of person completing this form: Gerry Vandenengel

Date this form was completed: [redacted]

The purpose of this form is to provide a brief description of any ideas that you feel could lead to patentable inventions by SPYRUS. It should be filled out and filed with the Legal Office. Once completed, a determination will be made of whether to proceed with a full invention disclosure.

SPYRUS is committed to building a strong patent portfolio, both to protect our intellectual property rights and to strengthen our corporate position. Please document anything that you may be working on which you feel could be patented.

All of the following entries should be made in ink or type.

RECEIVED [redacted] BY:

I. Give a descriptive title of the invention:

Method for communications for Portable Personal Smart Card Readers.

II. Give a brief statement explaining the essence of the invention and what benefit it provides. Use the space below (and on back, if necessary) for a sketch showing the important components of the invention.

Portable personal smart card readers are increasing in complexity and functionality while at the same time decreasing in cost. Economical design and reduced size are critical success factors for personal smart card readers. Two key features of personal smart card readers are:

1. Host or network communications capability. (the ability to connect a portable carry-along reader to a host computer so that it functions as a terminal).
2. Application reload capability, ie, the ability to allow the user to update or change the application programs for the reader.

This invention describes an innovative and compact method that combines both requirements. The Reader is implemented in 2 separate blocks, an I/O block and an Application Engine. Each block is implemented using a simple low cost micro-controller IC. (see block diagram). An asynchronous serial I/O channel provides connection to either a PC or other network host device through adapters. Internally this Serial I/O is connected to both the UART of the application engine and a serial port on the I/O block.

The I/O block has at least 2 other ports: 1) A card interface port for communications with smart and 2) a Synchronous Serial Channel for communications with the application engine. In addition, the I/O block has ports for display output and keypad input. Additional smart card interface ports may be added as

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well.

In normal use, the reader is either functioning in stand-alone mode (no external connection to host) or connected mode. (connected to a host PC or network). In either case, the Application engine operates as BUS Master for the synchronous serial channel to the I/O block, and the asynchronous serial I/O port on the I/O block is inactive, ie, the application engine is the Master and the I/O block is the Slave. In connected mode, if the reader is connected to a PC, the application can send and receive commands to the PC host over this serial channel. (Typically RS-232 or Universal Serial Bus)

In addition to normal use, a user can also update the program in the Application engine by reprogramming flash memory or EEPROM in that I/C. A user would initiate programming mode by entering a key control sequence on the reader keypad. The I/O block then becomes the Master and the Application engine is the Slave. In addition, the I/O block opens the asynchronous Serial I/O channel to the host PC using the same physical connection used in connected mode operation.

The application program code is then downloaded from the host PC through this serial channel and re-written to the Application Engine non-volatile memory through the Synchronous Serial Channel. In this case, the I/O block provides reset and oscillator drive to the Application Engine. When the application program re-load is complete, power is cycled to the reader and normal operation resumes.

[redacted]

This invention provides the following benefits over existing portable personal smart card readers:

1. It provides program reload capability in a low cost and compact design by using one physical serial channel to connect to host computers or networks. This one serial channel can be used for both regular operation as well as reader application re-programming, thereby saving real estate and costs for additional connectors or cables.

2. This invention allows the smart card interface to be used as an option to download the new code from a smart card to the application engine with no additional circuitry or components, as the smart card interface is already built in for normal use.

3. This invention combines both normal I/O operating functions such as the display driver, keypad interface and smartcard interface with the re-programming function into one low cost micro-controller. This eliminates the need for additional components, and also allows the application engine to be simplified as much of the processing is done by the I/O engine. Normally, a larger application engine with the necessary EEPROM or flash memory would increase the overall cost of the reader.

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DATE_____

III. What were the methods or apparatus that were used but failed to solve the problem? Give source of previous information on the subject that is closest to your invention.

The author is not aware of any personal portable smart card readers that can be programmed both through a PC serial connection as well as through a smart card. Typically, in-circuit programmers would require a separate programming circuit or connection. Other designs may use separate or discrete program memory components which would increase the overall reader cost and size.

IV. When did you first think of this invention?

The idea was first conceived about [redacted] and reduced to practice in [redacted] as described in several internal specifications.

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SPYRUS

SPYRUS INVENTION IDEA FORM

Docket No. (to be assigned by SPYRUS legal): PA5307-01-4027

Name of person completing this form: Paul Chau

Date this form was completed: [redacted]

The purpose of this form is to provide a brief description of any ideas that you feel could lead to patentable inventions by SPYRUS. It should be filled out and filed with the Legal Office. Once completed, a determination will be made of whether to proceed with a full invention disclosure.

SPYRUS is committed to building a strong patent portfolio, both to protect our intellectual property rights and to strengthen our corporate position. Please document anything that you may be working on which you feel could be patented.

All of the following entries should be made in ink or type.

I. Give a descriptive title of the invention:

Secure applications download processes for electronic devices

II. Give a brief statement explaining the essence of the invention and what benefit it provides. Use the space below (and on back, if necessary) for a sketch showing the important components of the invention.

As the application space for IC Card proliferating, many of the existing IC Card devices will be required to be compatible with the new application requirement. A new class of device having reloadability for its internal firmware started to emerge into the market. Since many of the new IC Card application involve financial and personal data exchange, it is crucial for such a reloadable device to be trusted and updated with legitimate application only. That in turns imposes a requirement for a secure procedure for application download. The secure application download process provides a way to authenticate both the device and the application sources before the device is updated with new application. It also protects the source data of the application by using a simple data encryption technique. The application source will be communicated with third party in an unprotected link, it is important to have temper resistance for the application source.

[redacted]

The process has support for combining a HEX file for a library application with the HEX file of the new application into one single HEX file.

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DATE [redacted]

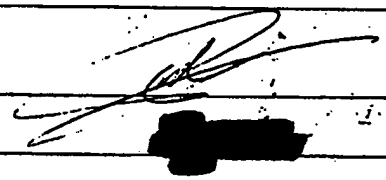
Details of the encryption technique have not been finalized yet at this point.

III. What were the methods or apparatus that were used but failed to solve the problem? Give source of previous information on the subject that is closest to your invention.

Some of these concepts on the secure download might be described before for different kind of device or application areas. However, this is a solution for a new problem that becomes feasible when the new class of device is introduced. Also, using the IC Card as a download medium is a new idea as well.

IV. When did you first think of this invention?

The idea of secure download has been discussed about 6 months ago when we start to conceptualize the design of the reloadable reader. At that point, we have only talked about using both the IC Card and the host as the interface for the application reload, we didn't have all the technique spelled out yet.

SIGNATURE 

DATE [redacted]

SPYRUS INVENTION DISCLOSURE

The purpose of this form is to secure the disclosure and a record date of your invention. It should be filled out as thoroughly as possible and filed with the Legal Office. A separate form may be used for each invention or modification of the invention and each sheet should be signed and dated by the inventor(s) and also signed and dated by two witnesses, by whom the contents of the disclosure have been read and understood.

All of the following entries should be made in ink or type.

I. Give a descriptive title of the invention:

The design of an IC Card interface system with application program reload capability.

II. Give a clear and concise statement explaining the essence of the invention. Use the space below for a sketch showing the important components of the invention. If the space below is inadequate, attach separate drawings or prints and description (properly signed, witnesses and dated, if possible).

The invention involves the design of a reloadable interface device for use with IC Card. Among all the existing IC Card interface devices, they can be categorized into two groups in respect of their capabilities. The first group is designed to be a carry-along device. This group of devices has specified card application embedded into the masked ROM of the internal micro-controller, and is intended to support a specified set of IC cards. Once the device has been built, the internal application cannot be modified to support any new requirements or new cards. The second group is designed to be a generic IC Card interface device that connects to an external host. The card application is running in the host and the reader is merely served as an interface conduit. This group of reader does not offer any standalone application capabilities. The invention proposed in here is a new kind of smart card interface device that captures the advantage from both groups of interface device. The proposed smart card interface device contains internal application that can be updated with a secure download process. The internal application enables the interface device to be used in standalone mode and the reloadable capability allows the interface device to be updated to support new cards or applications. The interface device is designed to be used in connected mode. In connected mode, the internal application is disable, the application is running at the host and using the resources in the reader.

Internal design of the reloadable interface system consists of two major functional blocks: Application Engine and an IO Engine. See attached block diagram for more details.

The partitioning offers the following advantages:

1. Functional Partition: IO engine is responsible for all the low-level IC Card interfaces, IO functions and the secure download process. Application engine is the storage for the card application and also being used as the data filtering during connected mode operation.
2. Flexibility in processor choice for both the IO engine and Application engine, and an easy migration path to merge the functions of the two processors into one single processor for cost saving.
3. Provide identical command data protocol for both standalone and connected mode application development. An application developed in connected mode can also be used in standalone mode.
4. Provide multi-card support and multi-sources application reloading.
5. Program memory in the application engine can be partitioned out to provide support for multi-applications storage as well as incremental update capabilities for the device.

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Although the idea of reloading software into a device has been proposed many times, this invention is different because it is a new class of device and it offers different kind of operation environment for different kind of entity. Currently there is no other IC Card interface device has that kind of application reloadablility. The reloadable reader is based on the design of the Value-Checker PLUS reader which is the first of its kind to have on-board keypad and LCD display for use in connected mode operation.

B. What are the problem(s) solved by the invention?

With the application reload capability, the proposed interface system solves the obsolesce problem that existed in most of the smart card interface devices. Many of the existing smart card interface device is custom designed to work with a specified set of cards to perform a specified application by loading into the Masked ROM of the micro-controller with the custom firmware. Once the device is built, it cannot be modified. Due to the fact that the smart card market is still in its infancy, the card specification and the application requirements are pronged to change at any time. When the specification of the card changed, the customized device will become obsolete. Even the cost of these custom devices is cheap enough to be a throwaway item, the cost to build a replacement device that works with the new specification is still very expensive. A typical cycle to produce a fixed firmware device is at least 12 weeks. And there is some substantial overhead cost involved in making the new device.

The memory space of the proposed device can be partitioned to store up multiple applications in a single unit. The same memory partitioning design also enables incremental upgrade for the interface device. This unique feature gives the customer the flexibility to deploy the device first before developing any specified application. And it also enables the customer to introduce new and upgrade applications to the device when they are in the field already. Since many of the smart card application deal with sensitive personal information, it is critical for the applications and the device to provide protection to such information. Because of security requirement, we need to ensure that only the legitimate applications can be loaded into an interface device. In the proposed device, the application download is implemented in a secure way to provide mutual authentication between the device and the incoming applications.

C. What were the methods or apparatus that were used but failed to solve the problem? Give source of previous information on the subject that is closest to your invention, such as known use, publication or patents.

As mentioned earlier, the proposed smart card interface system captures many of the advantages existed in some of the existing smart card devices. Most of the carry along device in the market is designed to have fixed firmware, and is designed to work a specified set of card and requirement in mind. This kind of device has simple input and output capabilities and is designed to extract simple information from the smart card and expose it to the user. The other kind of device is merely for use as a terminal for the smart card. They are attached to a host, and are served as an interface conduit between the application running in the host and the smart card. In general, this kind of device does not have any input and output capabilities as those carry alone devices. A new kind of device has been coming out to the market that combined the features of the carry along reader and host connected reader into a single entity. The first of its kind is the Value-Checker PLUS Smart Card Reader (it is now the Spyrus Personal Access Reader). The Spyrus Personal Access Reader is a compact size portable reader which can be customized with a specified card application, and is also a desktop reader which can connected to the host to provide an interface channel between the host and the card. Although the Personal Access Reader offers a lot of more features than most of the existing smart card reader/writer, it is a fixed firmware product, and it has the obsolesce problem.

SIGNATURE(S) OF INVENTOR(S)	DATE	SIGNATURES OF TWO WITNESSES	DATE

D. State how present invention differs from previous methods or apparatus and what advantages it provides.

Personal Access Reader has the fixed firmware that can not be upgraded once it is built. The device proposed in here uses re-programmable memory to provide the firmware reload capability, thus enable the device to be upgraded even when it is already in the field.

IV. What is the prospective value or utility of the invention for SPYRUS?

The current offering of the Personal Access reader is targeted as a connected mode smart card reader only. The next generation version, reloadable smart card reader, will be able to capture a bigger share of the smart card market. With its compact size, ease of use, applications reload capability and low cost, the proposed device will stand out among all the other existing readers. In addition, the secure download process and application development environment will further enhance the marketability of the device, and open up additional opportunity for Spyrus.

V. Give the Project No. which covers the work done, if any, and identify any monthly or other issued reports. (Attachment of pertinent pages would be helpful.)

The project number for this development is RDSPYA-62-XXXX.

VI. Have information, samples or technical bulletins relating to this invention been given to customer, have products relating to invention been sold, or has the process involved been used on a commercial scale? If the answer is yes, please give date and other details on an attached sheet.

The device is not yet for sale, it is still being developed. It is expected to be available in August of this year. The idea of the invention was originated form OKI, it has been disclosed to other companies under an NDA agreement in [redacted]

VII. When did you first think of this invention?

The idea of reloadable reader was conceptualized about 15 months ago as intended for the next generation of the Value-Checker PLUS reader family. The actual design was carried out [redacted] and the first prototype was built and tested in [redacted] There are several specifications have been written on the design of the reloadable reader.

VIII. What records do you have to substantiate this conception date? (Notebook numbers and pages, letters, reports, etc.) What is the date of first written description and/or drawing?

We have some specification describing the architecture of the reloadable readers. These documents were originated from OKI.

IX. Have you done any experimental work toward carrying out the invention? If so, when?

SIGNATURE(S) OF INVENTOR(S)	DATE	SIGNATURES OF TWO WITNESSES	DATE

The development is on-going right now. The concept has been proofed with demo hardware.

X. When and how did you make the first disclosure of the invention to others either orally or in writing?

The idea of the invention was originated form OKI, it has been disclosed to other companies under an NDA agreement in [redacted]. The write up on the patent application was done in [redacted]

XI. Give the date and description of past or future publications regarding or related to this invention.

No publications existed or planned for the inventions at this time.

XII. Is further experimental work now under way or contemplated for the near future? If so, give a general summary of such work and some idea of when this phase of the program will be completed.

The development of the proposed device is on-going, and it is expected to be completed in August of 1999.

XIII. Was this invention developed under a Government Contract? If yes, give the contract number.

No.

XIV. Furnish the following information for each inventor. Please copy this page as necessary.

NAME IN FULL	Paul Wai-Hung Chau	NAME IN FULL	Kerry Matthews
TITLE		TITLE	
CITIZENSHIP	Hong Kong, CHINA	CITIZENSHIP	USA
HOME ADDRESS	26 TRAVIS ROAD	HOME ADDRESS	

SIGNATURE(S) OF INVENTOR(S)	DATE	SIGNATURES OF TWO WITNESSES	DATE

CITY, COUNTY, STATE, and ZIP	NATICK, MA USA 01760	CITY, COUNTY, STATE, and ZIP	
SIGNATURE		SIGNATURE	
DATED		DATED	
SUPERVISOR'S NAME		SUPERVISOR'S NAME	

NAME IN FULL		NAME IN FULL	
TITLE		TITLE	
CITIZENSHIP		CITIZENSHIP	
HOME ADDRESS		HOME ADDRESS	
CITY, COUNTY, STATE, and ZIP		CITY, COUNTY, STATE, and ZIP	
SIGNATURE		SIGNATURE	
DATED		DATED	
SUPERVISOR'S NAME		SUPERVISOR'S NAME	

REVIEWED BY:

SUPERVISOR NAME_____ DATED:_____

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Exhibit C

SMARTREADER
DEVELOPMENT BOARD
APPLICATION ENGINE

SCHEMATIC TITLE DEFINITIONS:

!LINK			
!AE PROCESSOR.SCH	A/E ENGINE	TOP LEVEL	
!DEBUG.SCH	PROCESSOR	MICROPROCESSOR DEVICE	
!POWER..SCH	DEBUG HEADERS	DEBUG CONNECTIONS	
	POWER	POWER CONNECTIONS	

AE ENGINE INTERRUPT TABLE

TBD	TBD

INSERT DRAWING HERE

SMARTREADER II DEVELOPMENT BOARD - BLOCK DIAGRAM

REVISION HISTORY:

REV: - UNRELEASED

REVISION HISTORY:

REV: - UNRELEASED
REV: 0.1 FINAL NETLIST BEFORE CAD

NOTES:

1.) THIS IS A FLAT SCHEMATIC.

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FILE:A/E_TOP.SCH

[redacted]

AE ENGINE

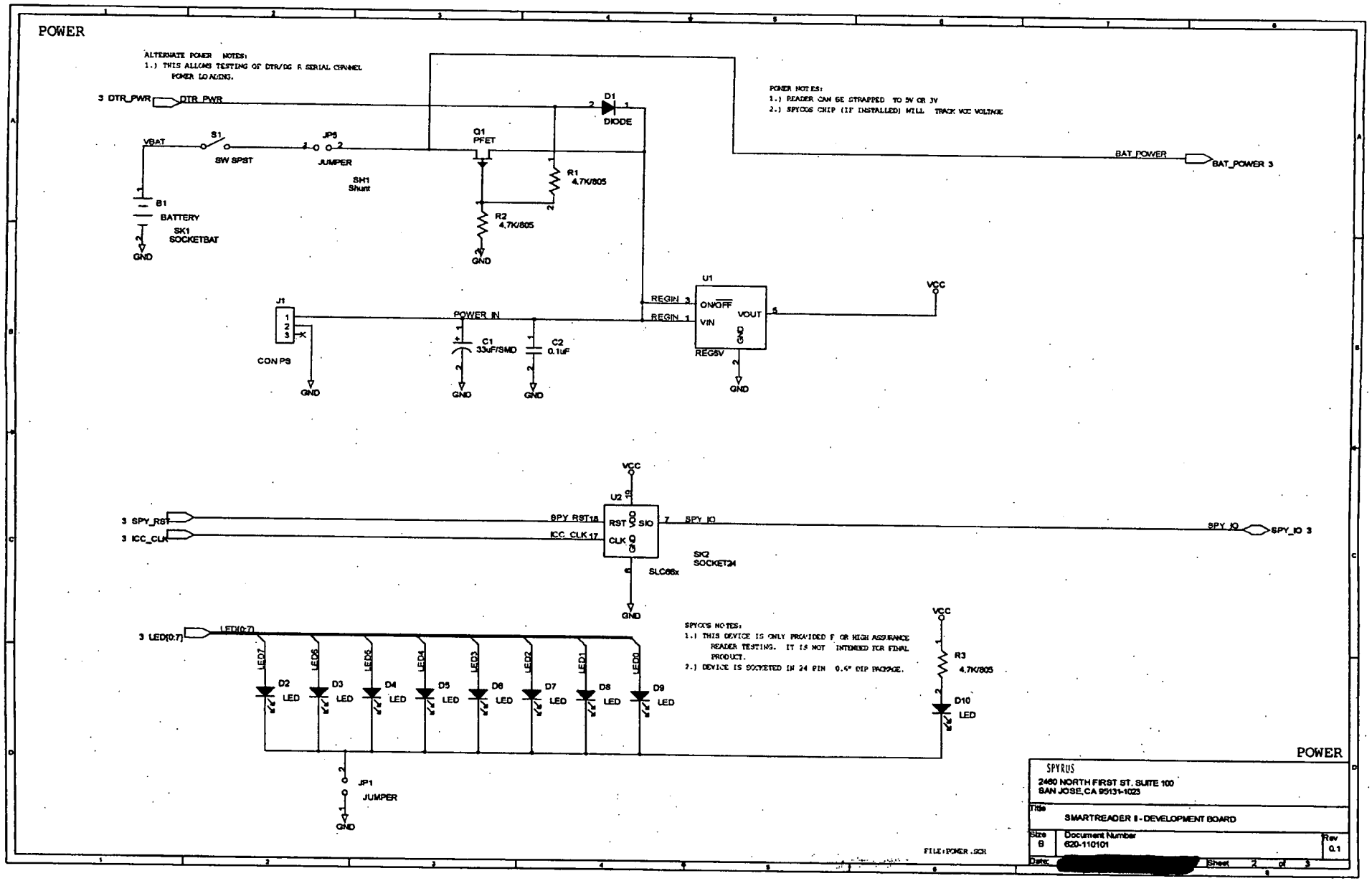
SPYRUS
2460 NORTH FIRST ST. SUITE 100
SAN JOSE, CA 95131-1023

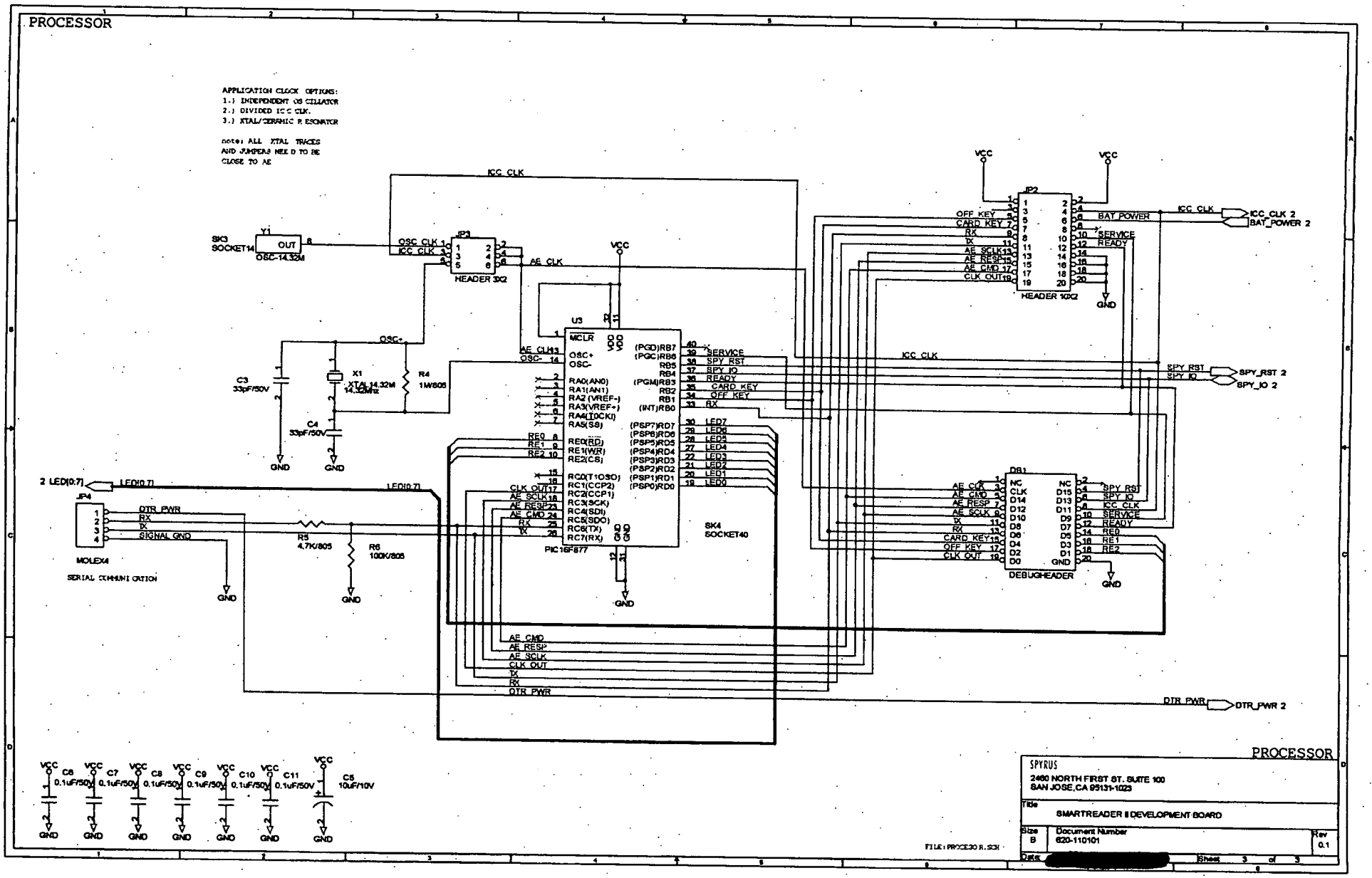
SMARTREADER II DEVELOPMENT BOARD

Size	CAGE Code	DWG NO	Rev
B		620-110101	0.1

Scale

Sheet 1 of 3


POWER
ALTERNATE POWER NOTES:
1.) THIS ALLOWS TESTING OF DTR/DG & SERIAL CHANNEL POWER LOADING.
3 DTR_PWR
DTR_PWR
D1
DIODE
POWER NOTES:
1.) READER CAN BE STRAPPED TO 5V OR 3V
2.) SPYCOS CHIP (IF INSTALLED) WILL TRACK VCC VOLTAGE
VBAT
S1
SW SPST
JP5
JUMPER
SH1
Shunt
Q1
PFET
R1
4.7K/805
R2
4.7K/805
BAT_POWER
BAT_POWER 3
B1
BATTERY
SK1
SOCKETBAT
GND
J1
CON PS
POWER IN
C1
33uF/SMD
C2
0.1uF
U1
REGIN
ON/OFF
VIN
VOUT
GND
REG5V
VCC
3 SPY_RST
3 ICC_CLK
SPY_RST18
ICC_CLK17
RST
CLK
SIO
SPY_IO
SPY_IO
SPY_IO 3
U2
SK2
SOCKET24
SLC66x
3 LED[0:7]
LED[0:7]
LED7
LED6
LED5
LED4
LED3
LED2
LED1
LED0
D2 LED
D3 LED
D4 LED
D5 LED
D6 LED
D7 LED
D8 LED
D9 LED
SPYCOS NOTES:
1.) THIS DEVICE IS ONLY PROVIDED F OR HIGH ASSURANCE READER TESTING. IT IS NOT INTENDED FOR FINAL PRODUCT.
2.) DEVICE IS SOCKETED IN 24 PIN 0.6" DIP PACKAGE.
R3
4.7K/805
D10
LED
JP1
JUMPER
FILE:POWER.SCH
POWER
SPYRUS
2460 NORTH FIRST ST. SUITE 100
SAN JOSE,CA 95131-1023
Title
SMARTREADER II - DEVELOPMENT BOARD
Size
B
Document Number
620-110101
Rev
0.1
Date:
Sheet 2 of 3


PROCESSOR
APPLICATION CLOCK OPTIONS:
1.) INDEPENDENT OSCILLATOR
2.) DIVIDED ICC CLK.
3.) XTAL/CERAMIC RESONATOR
note: ALL XTAL TRACES AND JUMPERS NEED TO BE CLOSE TO AE
ICC_CLK
SK3 SOCKET14
Y1 OSC-14.32M
JP3 HEADER 3X2
AE_CLK
VCC
U3
PIC16F877
SK4 SOCKET40
OSC+
OSC-
X1 XTAL 14.32MHz
C3 33pF/50V
C4 33pF/50V
R4 1M/805
GND
JP2 HEADER 10X2
OFF_KEY
CARD_KEY
RX
TX
AE_SCLK
AE_RESP
AE_CMD
CLK_OUT
BAT_POWER
SERVICE
READY
ICC_CLK 2
BAT_POWER 2
SPY_RST
SPY_IO
SPY_RST 2
SPY_IO 2
DB1 DEBUGHEADER
LED[0:7]
2 LED[0:7]
JP4 MOLEX4
DTR_PWR
SIGNAL GND
SERIAL COMMUNICATION
R5 4.7K/805
R6 100K/805
DTR_PWR 2
C6 0.1uF/50V
C7 0.1uF/50V
C8 0.1uF/50V
C9 0.1uF/50V
C10 0.1uF/50V
C11 0.1uF/50V
C5 10uF/10V
PROCESSOR
SPYRUS
2460 NORTH FIRST ST. SUITE 100
SAN JOSE,CA 95131-1023
SMARTREADER II DEVELOPMENT BOARD
Size B
Document Number 620-110101
Rev 0.1
Date:
Sheet 3 of 3
FILE: PROCESSOR.SCH

SMARTREADER
DEVELOPMENT BOARD
IO ENGINE

!LINK
!IO PROCESSOR.SCH
!DEBUG.SCH
!POWER..SCH

SCHEMATIC TITLE DEFINITIONS:

IO ENGINE	TOP LEVEL
PROCESSOR	MICROPROCESSOR DEVICE
DEBUG HEADERS	DEBUG CONNECTIONS
POWER	POWER CONNECTIONS

IO ENGINE INTERRUPT TABLE

TBD	TBD

INSERT DRAWING HERE

SMARTREADER II DEVELOPMENT - BLOCK DIAGRAM
IO ENGINE BOARD

REVISION HISTORY:

REV: - UNRELEASED
REV:0.1 RELEASED TO CAD

NOTES:

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FILE:IO_TOP.SCH

IO ENGINE

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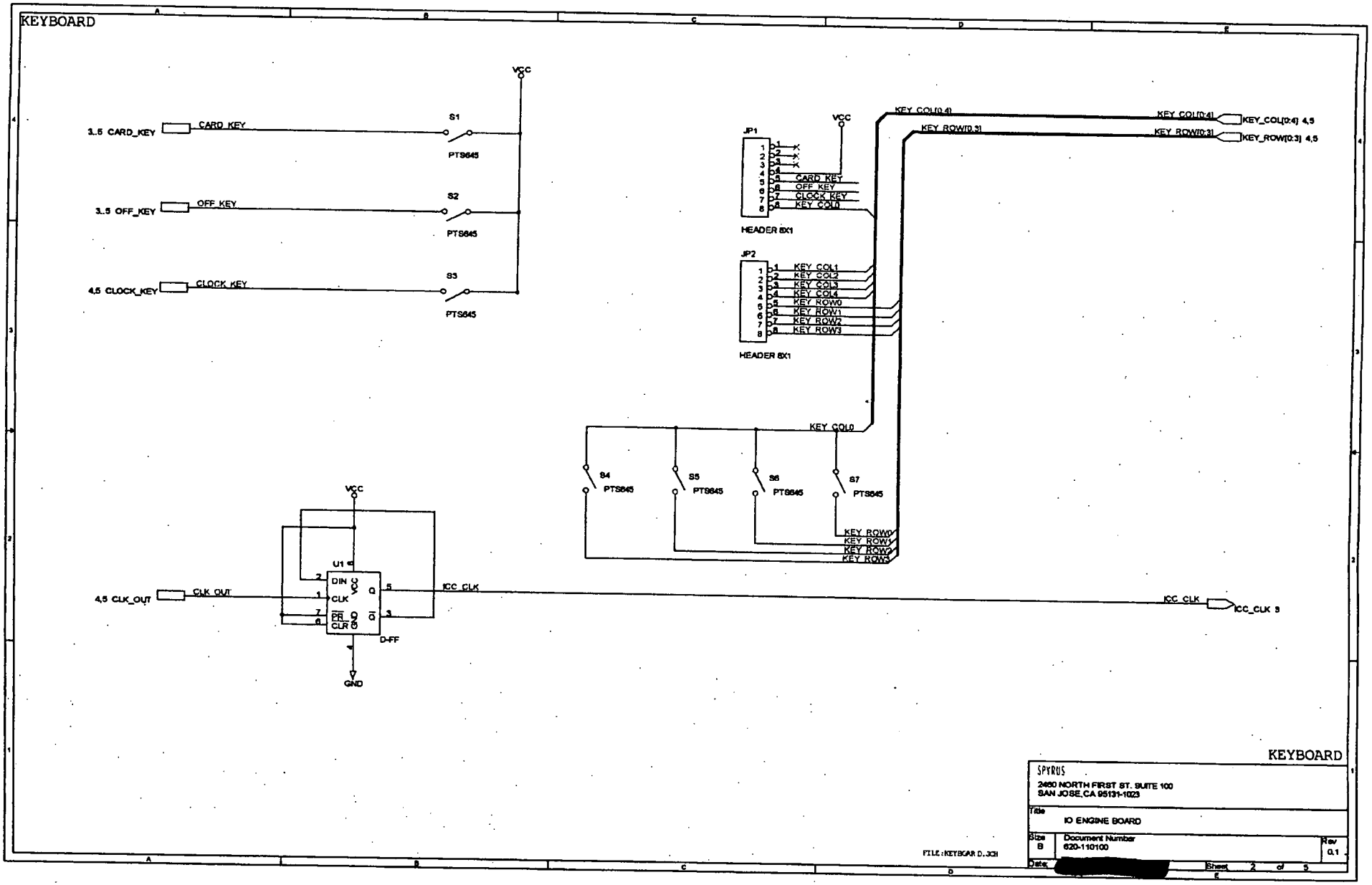
SPYRUS
2460 NORTH FIRST ST. SUITE 100
SAN JOSE, CA 95131-1023

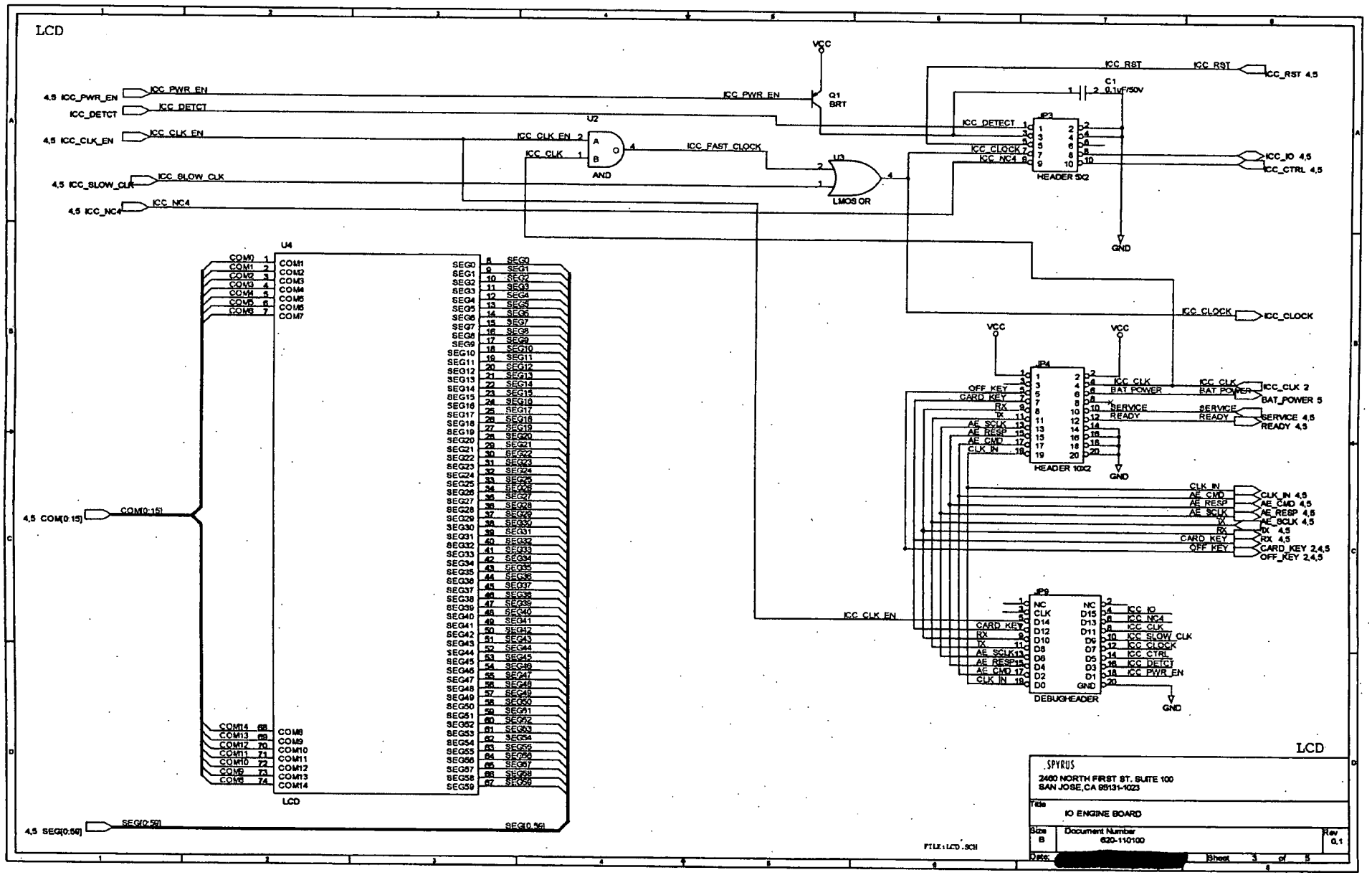
SMARTREADER II DEVELOPMENT
IO ENGINE BOARD

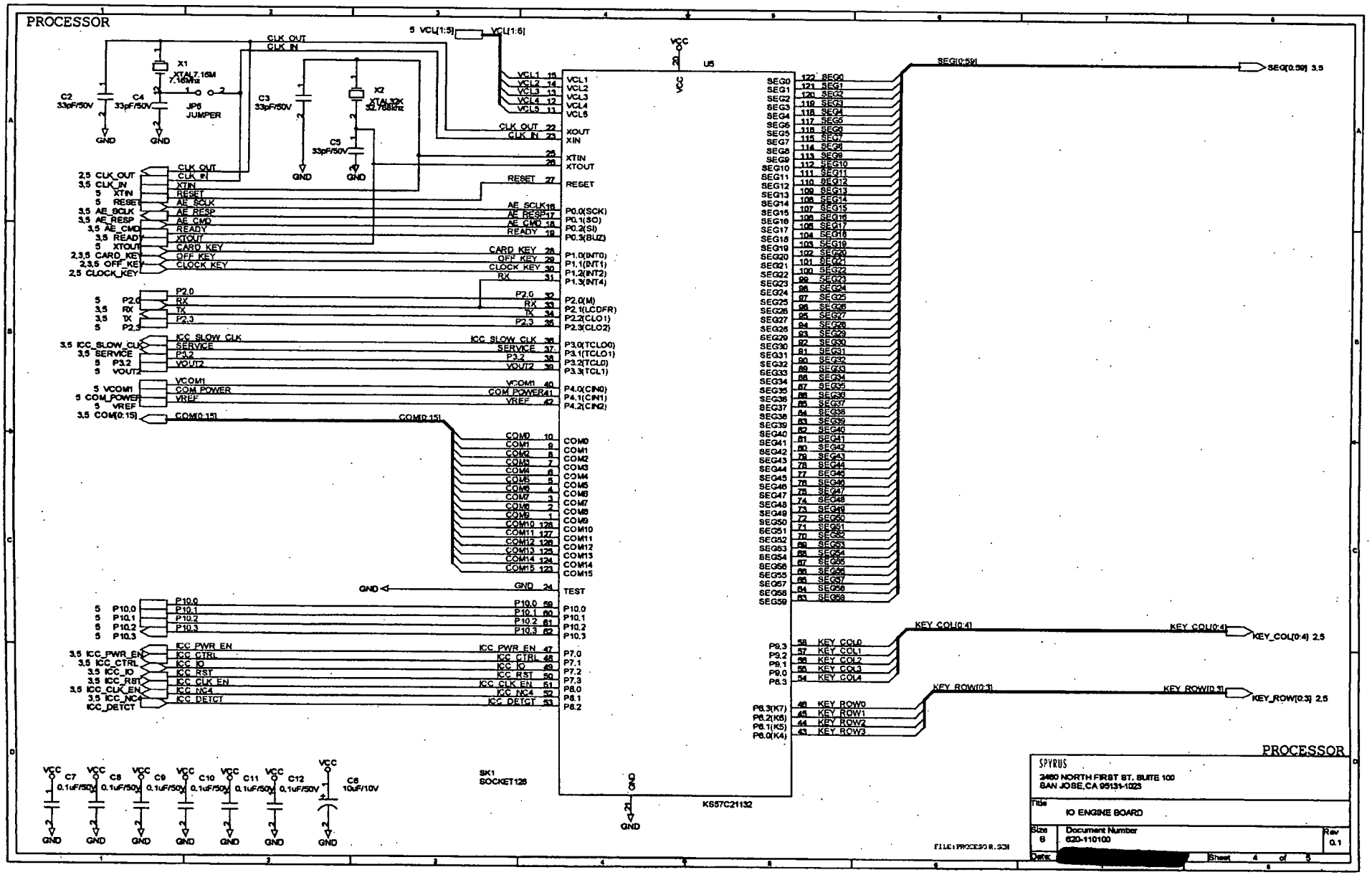
Size	CAGE Code	DWG NO	Rev
B		620-110100	0.1

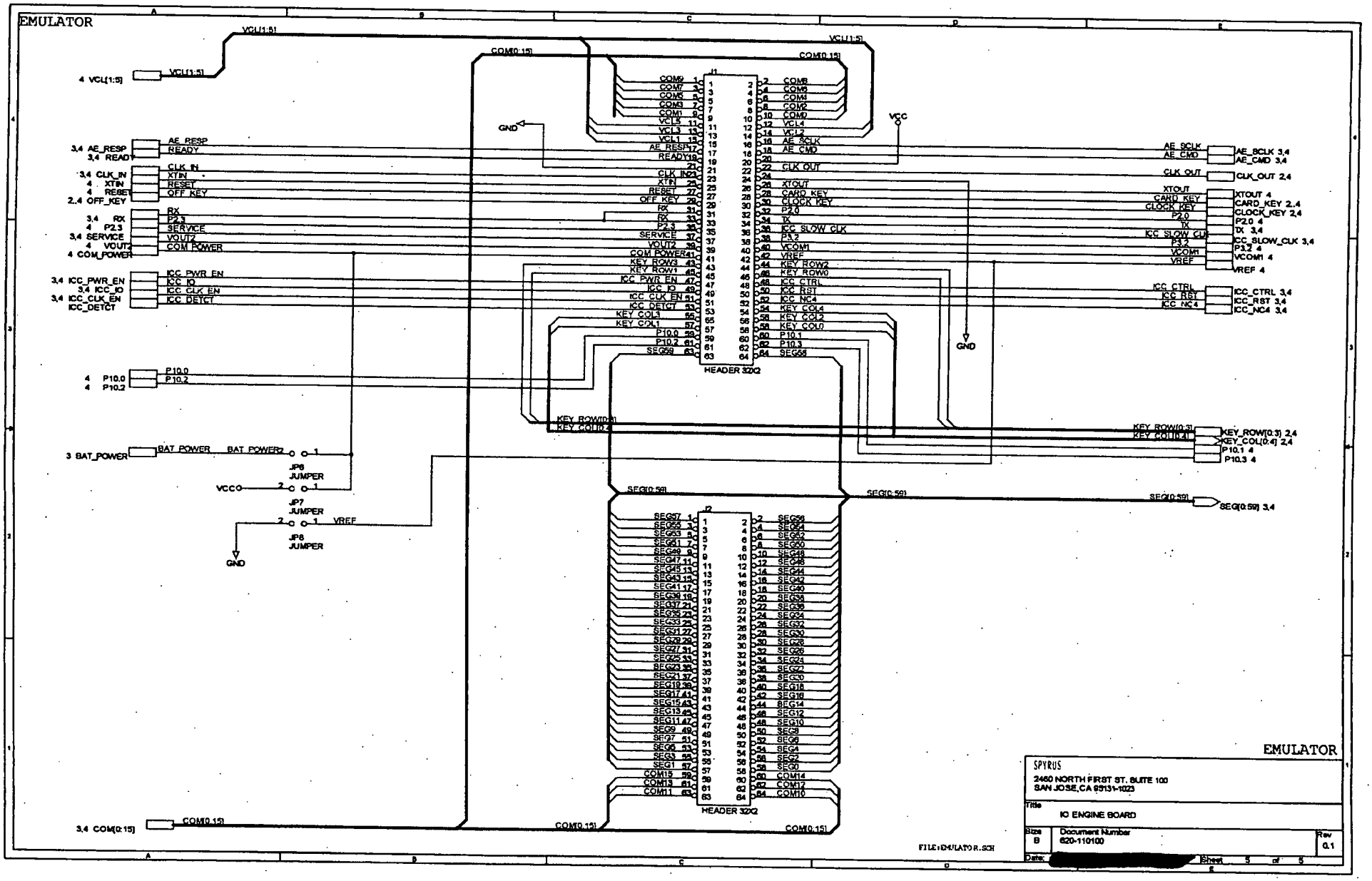
Scale

Sheet 1 of 5


KEYBOARD
VCC
3..5 CARD_KEY
CARD_KEY
S1
PTS645
3..5 OFF_KEY
OFF_KEY
S2
PTS645
4,5 CLOCK_KEY
CLOCK_KEY
S3
PTS645
JP1
CARD KEY
OFF KEY
CLOCK KEY
KEY COL0
HEADER 8X1
JP2
KEY COL1
KEY COL2
KEY COL3
KEY COL4
KEY ROW0
KEY ROW1
KEY ROW2
KEY ROW3
HEADER 8X1
KEY COL[0:4]
KEY ROW[0:3]
KEY_COL[0:4] 4,5
KEY_ROW[0:3] 4,5
S4
S5
S6
S7
PTS645
U1
DIN
CLK
PR
CLR
D-FF
GND
4,5 CLK_OUT
CLK_OUT
ICC_CLK
ICC_CLK 5
FILE:KEYBOAR D..3CH
SPYRUS
2460 NORTH FIRST ST. SUITE 100
SAN JOSE,CA 95131-1023
Title
IO ENGINE BOARD
Size
B
Document Number
620-110100
Rev
0.1
Date:
Sheet 2 of 5


LCD
VCC
4,5 ICC_PWR_EN
ICC_PWR_EN
ICC_DETCT
4,5 ICC_CLK_EN
ICC_CLK_EN
4,5 ICC_SLOW_CLK
ICC_SLOW_CLK
4,5 ICC_NC4
ICC_NC4
Q1
SRT
U2
AND
ICC_FAST_CLOCK
U3
LMOS OR
C1
0.1uF/50V
ICC_RST
ICC_RST 4,5
ICC_DETECT
ICC_CLOCK
JP3
HEADER 5X2
ICC_IO 4,5
ICC_CTRL 4,5
GND
U4
COM0
COM1
COM2
COM3
COM4
COM5
COM6
COM7
COM8
COM9
COM10
COM11
COM12
COM13
COM14
SEG0
SEG1
SEG2
SEG3
SEG4
SEG5
SEG6
SEG7
SEG8
SEG9
SEG10
SEG11
SEG12
SEG13
SEG14
SEG15
SEG16
SEG17
SEG18
SEG19
SEG20
SEG21
SEG22
SEG23
SEG24
SEG25
SEG26
SEG27
SEG28
SEG29
SEG30
SEG31
SEG32
SEG33
SEG34
SEG35
SEG36
SEG37
SEG38
SEG39
SEG40
SEG41
SEG42
SEG43
SEG44
SEG45
SEG46
SEG47
SEG48
SEG49
SEG50
SEG51
SEG52
SEG53
SEG54
SEG55
SEG56
SEG57
SEG58
SEG59
LCD
4,5 COM[0:15]
COM[0:15]
4,5 SEG[0:59]
SEG[0:59]
ICC_CLOCK
ICC_CLOCK
JP4
HEADER 10X2
OFF_KEY
CARD_KEY
RX
TX
AE_SCLK
AE_RESP
AE_CMD
CLK_IN
BAT_POWER
SERVICE
READY
ICC_CLK 2
BAT_POWER 5
SERVICE 4,5
READY 4,5
CLK_IN 4,5
AE_CMD 4,5
AE_RESP 4,5
AE_SCLK 4,5
TX 4,5
RX 4,5
CARD_KEY 2,4,5
OFF_KEY 2,4,5
JP9
DEBUGHEADER
ICC_CLK_EN
ICC_IO
ICC_NC4
ICC_CLK
ICC_SLOW_CLK
ICC_CLOCK
ICC_CTRL
ICC_DETCT
ICC_PWR_EN
SPYRUS
2460 NORTH FIRST ST. SUITE 100
SAN JOSE,CA 95131-1023
Title
IO ENGINE BOARD
Size
B
Document Number
620-110100
Rev
0.1
Date:
Sheet 3 of 5
FILE:LCD.SCH


PROCESSOR
5 VCL[1:5]
VCL[1:6]
CLK OUT
CLK IN
X1
XTAL7.16M
7.16MHz
C2
33pF/50V
C4
33pF/50V
JP6
JUMPER
C3
33pF/50V
X2
XTAL32K
32.768kHz
C5
33pF/50V
GND
VCC
U5
VCL1 15
VCL2 14
VCL3 13
VCL4 12
VCL5 11
CLK_OUT 22
CLK_IN 23
25
26
RESET 27
AE_SCLK 16
AE_RESP 17
AE_CMD 18
READY 19
CARD_KEY 28
OFF_KEY 29
CLOCK_KEY 30
RX 31
P2.0 32
RX 33
TX 34
P2.3 35
ICC_SLOW_CLK 36
SERVICE 37
P3.2 38
VOUT2 39
VCOM1 40
COM_POWER 41
VREF 42
COM0 10
COM1 9
COM2 8
COM3 7
COM4 6
COM5 5
COM6 4
COM7 3
COM8 2
COM9 1
COM10 126
COM11 127
COM12 126
COM13 125
COM14 124
COM15 123
GND 24
P10.0 59
P10.1 60
P10.2 61
P10.3 62
ICC_PWR_EN 47
ICC_CTRL 48
ICC_IO 49
ICC_RST 50
ICC_CLK_EN 51
ICC_NC4 52
ICC_DETCT 53
P0.0(SCK)
P0.1(SO)
P0.2(SI)
P0.3(BUZ)
P1.0(INT0)
P1.1(INT1)
P1.2(INT2)
P1.3(INT4)
P2.0(M)
P2.1(LCDFR)
P2.2(CLO1)
P2.3(CLO2)
P3.0(TCLO0)
P3.1(TCLO1)
P3.2(TCL0)
P3.3(TCL1)
P4.0(CIN0)
P4.1(CIN1)
P4.2(CIN2)
TEST
P7.0
P7.1
P7.2
P7.3
P8.0
P8.1
P8.2
P8.3(K7)
P8.2(K6)
P8.1(K5)
P8.0(K4)
KS57C21132
SK1
SOCKET128
SEG0 122
SEG1 121
SEG2 120
SEG3 119
SEG4 118
SEG5 117
SEG6 116
SEG7 115
SEG8 114
SEG9 113
SEG10 112
SEG11 111
SEG12 110
SEG13 109
SEG14 108
SEG15 107
SEG16 106
SEG17 105
SEG18 104
SEG19 103
SEG20 102
SEG21 101
SEG22 100
SEG23 99
SEG24 98
SEG25 97
SEG26 96
SEG27 95
SEG28 94
SEG29 93
SEG30 92
SEG31 91
SEG32 90
SEG33 89
SEG34 88
SEG35 87
SEG36 86
SEG37 85
SEG38 84
SEG39 83
SEG40 82
SEG41 81
SEG42 80
SEG43 79
SEG44 78
SEG45 77
SEG46 76
SEG47 75
SEG48 74
SEG49 73
SEG50 72
SEG51 71
SEG52 70
SEG53 69
SEG54 68
SEG55 67
SEG56 66
SEG57 65
SEG58 64
SEG59 63
SEG[0:59]
SEG[0:59] 3,5
KEY_COL[0:4]
KEY_COL[0:4] 2,5
KEY_ROW[0:3]
KEY_ROW[0:3] 2,5
P8.3 58 KEY_COL0
P9.2 57 KEY_COL1
P9.1 56 KEY_COL2
P9.0 55 KEY_COL3
P8.3 54 KEY_COL4
46 KEY_ROW0
45 KEY_ROW1
44 KEY_ROW2
43 KEY_ROW3
C7 0.1uF/50V
C8 0.1uF/50V
C9 0.1uF/50V
C10 0.1uF/50V
C11 0.1uF/50V
C12 0.1uF/50V
C6 10uF/10V
PROCESSOR
SPYRUS
2460 NORTH FIRST ST. SUITE 100
SAN JOSE,CA 95131-1023
Title
IO ENGINE BOARD
Size B
Document Number 620-110100
Rev 0.1
Date
Sheet 4 of 5
FILE: PROCESO R..SCH


EMULATOR
VCL[1:5]
COM[0:15]
GND
VCC
HEADER 32X2
SEG[0:59]
KEY_ROW[0:3]
KEY_COL[0:4]
JP6 JUMPER
JP7 JUMPER
JP8 JUMPER
VREF
VCCO
BAT_POWER
BAT_POWER2
AE_RESP
READY
CLK_IN
XTIN
RESET
OFF_KEY
RX
P2.3
SERVICE
VOUT2
COM_POWER
ICC_PWR_EN
ICC_IO
ICC_CLK_EN
ICC_DETCT
P10.0
P10.2
P10.1
P10.3
AE_SCLK
AE_CMD
CLK_OUT
XTOUT
CARD_KEY
CLOCK_KEY
P2.0
TX
ICC_SLOW_CLK
P3.2
VCOM1
ICC_CTRL
ICC_RST
ICC_NC4
FILE:EMULATOR.SCH
SPYRUS
2460 NORTH FIRST ST. SUITE 100
SAN JOSE, CA 95131-1023
IO ENGINE BOARD
Document Number
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0.1
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